

FINAL

EXECUTIVE SUMMARY

AIRCRAFT ACCIDENT INVESTIGATION B-2A, T/N 88-0332 ANDERSEN AIR FORCE BASE, GUAM 26 FEBRUARY 2010

On 26 February 2010, at 0645 local time, the mishap aircraft (MA), a B-2A, tail number 88-0332, assigned to the 509th Bomb Wing and deployed to Andersen Air Force Base (AFB), Guam, caught fire during ground operations at Andersen AFB. The damage to the MA is estimated at \$64.4 million. One person sustained minor fume inhalation injuries and has since fully recovered. There was no other damage to personal or government property.

The mishap occurred during preflight preparation. The mishap crew (MC) started all four engines normally. However, generator #1 did not integrate, so the MC shut down engine #1 as part of an approved procedure to reestablish operation of the generator. Four minutes after engine #1 shutdown, the MC prepared engine #1 for restart by motoring it with bleed air provided by engine #2. During motoring a reverse airflow condition was established that ingested air into the tailpipe bay that contained the exhaust nozzle and tailpipe of engine #1. After motoring until the engine reached the correct speed, the MC pressed the start button, which initiated fuel flow and ignition. There was a slight delay in ignition, which allowed unburned fuel vapor to be drawn into the tailpipe bay and then ignited by an "ignition flash" event. The crew chief saw a flash at the engine, but neither he nor the MC were alarmed, since such delayed ignitions and associated flash occasionally occur on B-2s with no ill effect. Unbeknownst to the MC and crew chief, the flash ignited "E-Foam" insulating material that lined the tailpipe bay. The generator still did not integrate. As part of continued troubleshooting, the MC subsequently shut down engine #1 again. Two minutes later the MC and crew chief saw and smelled smoke. The MC shutdown the remaining three engines and safely egressed the MA. Maintenance personnel fought the fire with halon bottles until fire trucks arrived approximately five minutes later. The fire was contained in approximately 26 minutes after approximately 34,000 gallons of fire suppressing agent was sprayed on the MA. Lack of awareness of the B-2A tailpipe bay led to firefighter difficulty in effectively concentrating their effort at the source of the fire.

The AIB president found by clear and convincing evidence that the fire was caused by the ignition of unburned fuel vapors that had been introduced to the tailpipe bay by a reverse airflow condition during engine start. This ignition flash in turn ignited oil-soaked degraded E-Foam material in the outboard section of the tailpipe bay. Heat emitted from the fire caused a hydraulic line to rupture, further fueling the flames. The fire spread forward by the continuing reverse airflow condition causing further damage. Additionally, the AIB president found by substantial evidence that the following factors contributed to the extent of the mishap: aircraft design issues, inadequate aircrew technical order guidance, and lack of awareness about B-2 tailpipe bay fire hazards in the fire fighting community.

Under 10 U.S.C. 2254(d), any opinion of the accident investigators as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report may not be considered as evidence in any civil or criminal proceeding arising from the accident, nor may such information be considered an admission of liability of the United States or by any person referred to in those conclusions or statements.